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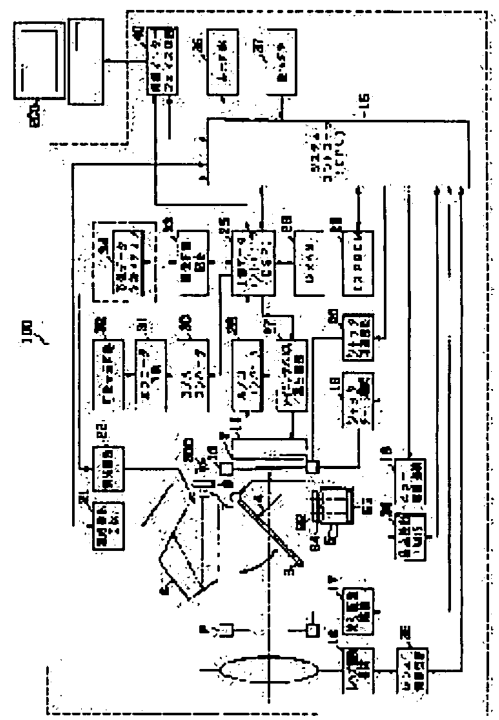
(54) ELECTRONIC IMAGE PICK-UP DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To accurately and easily conduct focusing position adjustment for an image pick-up element.

SOLUTION: Respective auto-focusing data are provided from an AF sensor module 5 and an image sensor 11 arranged in mutually conjugated positions in a test mode to store a relative shift data between the auto-focusing data, and a photographing lens 1 is driven based on the relative shift data in an ordinary mode.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electronic image pickup device which performs photography actuation using a solid state image sensor.
[0002]
[Description of the Prior Art] Conventionally, generally the focal detection approach of a TTL phase contrast method is used with the camera of the single lens reflex camera REXX method which can be photoed using the silver halide film. However, it is difficult to make in agreement with an actual film plane the focus location detected by this phase contrast method. This is based on various factors, such as an error generated in case the sensor module of a phase contrast method is attached in the body of a camera, and a dimension error of the optical system which constitutes a sensor module.
[0003] Moreover, in the production process of a camera, adjustment actuation for amending the gap with the focus location and film plane which are generally detected by the phase contrast method is performed. This adjustment actuation is performed at the process near the final process of the production process of a camera, and first, a taking lens is adjusted so that the photographic subject image of a predetermined distance may carry out image formation to a film plane using an autocollimator. Next, focal detection actuation of a phase contrast method is performed in this condition, and a parameter required in order to amend the above-mentioned gap is determined.
[0004] That is, the flux of light from the photographic subject which is in infinite distance equivalent using an autocollimator is floodlighted to a taking lens, and the sensor for detecting the contrast of the image which a taking lens forms in the film plane of a camera is arranged temporarily. And the location where contrast serves as max from the output of a sensor is detected letting out a taking lens, and let the amount of deliveries at this time be infinity positional information, after rounding a taking lens most.
[0005]
[Problem(s) to be Solved by the Invention] By the way, in the one eye reflex camera using a silver halide film, since the exposure side of a film will be exposed if a back lid is opened, adjustment by autocollimator which was mentioned above can be performed easily.
[0006] However, since an electronic camera does not need film loading, an after lid does not exist. Therefore, the sensor which detects contrast cannot be attached temporarily.
[0007] Moreover, since there are image sensors, such as CCD, it is difficult for the location equivalent to a film plane to perform adjustment actuation which used the autocollimator.
[0008] Therefore, in the camera system which does not expose the field which is equivalent to a film plane like an electronic camera, adjustment mentioned above by another technique needed to be performed.
[0009] This invention is made in view of this situation, and it aims at offering the electronic image pickup device which can perform focus justification of an image sensor more correctly and simple.
[0010]
[Means for Solving the Problem] In order to attain the above-mentioned purpose the 1st electronic image pickup device of this invention A 1st focal detection means to carry out photo electric conversion of a pair of image which a pair of flux of light which passed the image pick-up lens forms, respectively, to detect relative spacing

of the image of these pairs, and to output the 1st automatic focus data about punctate [of this image pick-up lens], While outputting the picture signal which carried out photo electric conversion of the image which the flux of light which passed the image pick-up lens forms The mode setting means which can be set to a 2nd focal detection means to evaluate the contrast of a picture signal and to output the 2nd automatic focus data about punctate [of this image pick-up lens], and the normal mode and a static test mode, and when it is in the above-mentioned static test mode, While controlling the above-mentioned 1st and 2nd focal detection means and memorizing the relative gap data of the above-mentioned 1st and 2nd automatic focus data If it is in the above-mentioned normal mode, it is characterized by providing the control means which drives the above-mentioned image pick-up lens based on the above-mentioned relative gap data remembered to be the above-mentioned 1st automatic focus data.
[0011] In order to attain the above-mentioned purpose, the 2nd electronic image pickup device of this invention is further equipped with an optical-path division means in the 1st electronic image pickup device of the above, and the light-receiving side of the above-mentioned 1st focal detection means and the light-receiving side of the above-mentioned 2nd focal detection means are characterized by allotting mutually a location [****].
[0012] In order to attain the above-mentioned purpose, the 3rd electronic image pickup device of this invention is characterized by performing the above-mentioned contrast evaluation with an external operation means to have further an output means to output the above-mentioned picture signal, and to analyze the outputted image data in the 1st electronic image pickup device of the above.
[0013]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.
[0014] Drawing 1 is the block diagram having shown the configuration of the electronic camera which is the 1st operation gestalt of this invention.
[0015] As shown in drawing 1 , the electronic camera 100 of this operation gestalt is led to the quick return mirror 3 rotatable in the direction of an arrow head to illustrate through the diaphragm 2 whose photography flux of light from the photographic subject image which is not illustrated is an exposure means for adjusting a taking lens 1 and the quantity of light. The center section of the quick return mirror 3 is a half mirror, and when this quick return mirror 3 is downed, a part of flux of lights penetrate it. And it is reflected by the submirror 4 installed in the quick return mirror 3, and this transmitted flux of light is led to AF sensor module 5.
[0016] On the other hand, the photography flux of light reflected by the quick return mirror 3 results in a photography person's eyes through a pentaprism 6 and an ocular 7.
[0017] Moreover, when the quick return mirror 3 rises, the flux of light from the above-mentioned taking lens 1 results in the image sensors 11 represented by CCD as an image sensor etc. through a filter 9 and the focal plane shutter 10 which is a machine shutter. The above-mentioned filter 9 is the function to have two functions, and for one to cut infrared radiation, and to lead only a visible ray to image sensors 11, and another is a function as an optical low pass filter. Moreover, a focal plane shutter 10 is a protection-from-light means to have a point curtain and a back curtain, to change, to penetrate the flux of light from a taking lens 1, and to control cutoff.
[0018] In addition, the submirror 4 is folded up at the time of the rise of the quick return mirror 3.
[0019] Moreover, the electronic camera 100 of this operation gestalt is equipped with the system controller 15 constituted by CPU which manages control of the whole electronic camera concerned, and controls suitably actuation of each part mentioned later.
[0020] The lens control circuit 39 which controls the lens drive 16 for the above-mentioned system controller 15 moving the above-mentioned taking lens 1 in the direction of an optical axis, and performing focus doubling, The drawing drive 17 for driving the above-mentioned diaphragm 2, and the mirror drive 18 for driving up and down of the quick return mirror 3, The shutter charge device 19 which controls shutter charge of a focal plane shutter 10, The shutter control circuit 20 for controlling transit of the point curtain of a focal plane shutter 10, and a back curtain, The photometry circuit 22 connected to the photometry sensor arranged near the above-mentioned ocular 7, EEPROM23 by which the parameter to be adjusted is remembered to be the look detector 21 connected to the look detecting element 8 which is similarly prepared near the ocular 7 and detects the photography person's 300 look when controlling the electronic camera 100 concerned is connected.
[0021] Moreover, the external control unit 200 represented by the personal computer (PC) is connectable, and

the communication link of this personal computer 200 and a system controller 15 of the electronic camera 100 concerned is attained for it through the communication link interface circuitry 40.
[0022] The photometry sensor connected to the above-mentioned photometry circuit 22 is a sensor for measuring the brightness of the photographic subject which is not illustrated, and the output is supplied to a system controller 15 through the photometry circuit 22.
[0023] The above-mentioned look detector 21 receives the information from the look detecting element 8 that the photography person's 300 look is detected, and sends out this detection result to a system controller 15. A system controller 15 chooses specific area from two or more focal area based on this detection result.
[0024] Moreover, the above-mentioned system controller 15 carries out image formation of the photographic subject image on image sensors 11 by controlling the above-mentioned lens drive 16. Moreover, a system controller 15 controls the diaphragm drive 17 which drives diaphragm 2 based on set-up Av value, and outputs a control signal to the above-mentioned shutter control circuit 20 further based on set-up Tv value.
[0025] The driving source is constituted by the spring and the point curtain of the above-mentioned focal plane shutter 10 and a back curtain require spring charge after shutter transit for the next actuation. The shutter charge device 19 controls this spring charge.
[0026] Moreover, the image data controller 25 is connected to the above-mentioned system controller 15. This image data controller 25 is the amendment data sample means and amendment means which are constituted by DSP (digital signal processor), and performs control of image sensors 11, amendment, processing of the image data inputted from these image sensors 11, etc. based on the command of a system controller 15.
[0027] The timing pulse generating circuit 27 which outputs a pulse signal required for it in case image sensors 11 are driven for the above-mentioned image data controller 25, The timing pulse generated with image sensors 11 in the timing pulse generating circuit 27 is received. A/D converter 28 for changing into a digital signal the analog signal corresponding to the photographic subject image outputted from these image sensors 11, DRAM29 which memorizes the obtained image data (digital data) temporarily, and D/A converter 30 and the picture compression circuit 33 are connected.
[0028] The above DRAM 29 is used as a storage means for memorizing temporarily the image data before data conversion to processing or a predetermined format is performed.
[0029] Moreover, the image display circuit 32 is connected to above-mentioned D/A converter 30 through an encoder 31. Furthermore, the image data-logging media 34 are connected to the picture compression circuit 33.
[0030] The above-mentioned image display circuit 32 is a circuit for displaying the image data picturized with image sensors 11, and, generally is constituted by the liquid crystal display component of a color.
[0031] The image data controller 25 changes the image data on DRAM29 into an analog signal by D/A converter 30, and outputs it to the encoder circuit 31. In case the encoder circuit 31 drives the above-mentioned image display circuit 32 for the output of this D/A converter 30, it is changed into a required video signal (for example, NTSC signal).
[0032] The above-mentioned picture compression circuit 34 is a circuit for performing the compression and conversion (for example, JPEG) of image data which were memorized by DRAM29. The changed image data is stored in the image data-logging media 34. As this archive medium, a hard disk, a flash memory, a floppy disk, etc. are used.
[0033] further -- a system controller -- 15 -- **** -- being concerned -- an electronic camera -- a mode of operation -- information -- exposure -- information (at the time of a shutter second diaphragm value etc.) -- a display -- carrying out -- a sake -- action indication -- a circuit -- 36 -- a user -- a request -- actuation -- being concerned -- an electronic camera -- performing -- it should make -- operating it -- having -- a large number -- a switch -- constituting -- having -- actuation -- a switch -- (-- SW --) -- 37 -- connecting -- having -- **** .
[0034] Next, the above-mentioned taking lens 1 and the lens drive 16 are explained in detail with reference to drawing 2 and drawing 3 .
[0035] Drawing 2 is the important section appearance perspective view having shown the taking lens and lens drive in an electronic camera of an operation gestalt of **** 1, and drawing 3 is the important section sectional view having shown some of taking lenses in this electronic camera, lens drives, and bodies of a camera.
[0036] As shown in drawing 2 , it is held in the focusing frame 52, and the focusing frame gear 53 is arranged by the end of the focusing frame 52 in one, and a taking lens 1 engages with the power transmission device 46

mentioned later. Furthermore, the helicoid 54 is formed in the periphery of the focusing frame 52.
[0037] moreover, the lens drive 16 which drives this taking lens 1 -- a driving source -- it comes out with the power transmission device 46 which becomes the pinion gear 42 and this which were prepared in the output shaft of a motor 41 and this motor 41 from the gears 43, 44, and 45 which gear one by one, the rotation slit 47 which it is arranged in a gear 43 and the same axle, and is rotated at the same rotational frequency, and the photo interrupter 48 for this rotation slit 47, and is constituted.
[0038] In addition, the above-mentioned power transmission device 46 gears with the above-mentioned focusing frame gear 53 in the last stage. Thereby, the turning effort of the above-mentioned motor 41 is transmitted to this focusing frame gear 53 through the above-mentioned power transmission device 46, consequently the focusing frame 52 rotates it.
[0039] Moreover, the amount of deliveries of a taking lens 1 is detected at the pulse signal outputted from the above-mentioned photo interrupter 48 being inputted into a system controller 15 through the lens control circuit 39, and a system controller 15 counting this pulse signal.
[0040] As shown in drawing 3 , a taking lens 1 (focusing frame 52) and the lens drive 16 are arranged in the mirror frame 56 fixed to some bodies 55 of a camera in one. Moreover, a fixed frame 57 is fixed to the front end section of a mirror frame 56 by the flange. Helicoid 57a is formed in the frame part inner skin of this fixed frame 57, and it fits in with the helicoid 54 prepared in the above-mentioned focusing frame 52.
[0041] Thus, although the focusing frame 52 engages with a fixed frame 57 and endocyst is carried out to a mirror frame 56, the above-mentioned lens drive 16 41, i.e., a motor, and power-transmission-device 46 grade are arranged in the space formed between the focusing frame 52 and a mirror frame 56 by one side.
[0042] By the configuration of such a focusing frame 52 and the lens drive 16, if a motor 41 rotates in this direction with the direction signal of CCW (based on directions from a system controller 1), the focusing frame 52 will move so that it may let out to a fixed frame 57. The migration by this delivery is possible until back end section 53b of the focusing frame gear 53 and back end side 57b of a fixed frame 57 are guessed and attached.
[0043] On the other hand, if it rotates in this direction with the direction signal of CW, the focusing frame 52 will move so that it may march in to a fixed frame 57. this migration depended for marching in -- some of back end side 53a of the focusing frame gear 53, and bodies of a camera -- it is possible until 55a is guessed and attached.
[0044] Next, the above-mentioned AF sensor module 5 is explained in detail with reference to drawing 4 . As shown in drawing 4 , AF sensor module 5 is a sensor which the principal part consists of the visual field mask 62, the condensing lens group 64, a separator lens group 65, a diaphragm mask 63, and line sensor 66 grade, divides the flux of light from photographic subjects 61a-61c by the pupil division optical system corresponding to each focal area FA1, FA2, and FA3, is made to carry out image formation on the above-mentioned line sensor 66 which is 1-dimensional CCD, and performs focal detection by the phase contrast method.
[0045] That is, a taking lens 1 is penetrated, the stray light is removed by the visual field mask 62, and incidence of the photographic subject light of the focal area FA1, FA2, and FA3 in the photography area 61 corresponding to photographic subjects 61a, 61b, and 61c is carried out to the condensing lens group 64 (condensing lenses CL1, CL2, and CL3) corresponding to each.
[0046] Photographic subject light is projected on the opening pupil posion where it extracts by this condensing lens group 64, and a mask 63 corresponds. The separator lens group 65 (separator lens SL1a/SL1b, SL2 a/SL2b, SL3a/SL3b) used as each set is arranged by opening of the above-mentioned diaphragm mask 63. And image formation of the light from the exit pupil of the taking lens 1 which extracts as condensing lenses 1-CLs 3, and is determined by opening of a mask 63 is carried out on S1 and S2 of the line sensor 66 which corresponds, respectively by each above-mentioned separator lens SL1a/SL1b, SL2 a/SL2b, and SL3 a/SL3b, and step S3.
[0047] In addition, each line sensor S1 - step S3 are constituted by two groups and a group used as a pair, and b group, and two images which the separator lens of a pair constitutes are projected on the sensor of each image. By detecting spacing of two images used as the pair on this line sensor S1 - step S3, the amount of defocusing of gaps to the film plane of the photographic subjects 61a-61c of the focal area FA1-FA3 corresponding to each sensor, i.e., the amount from the focus location of a taking lens, can be calculated. The above-mentioned amount of defocusing can be calculated based on the phase contrast operation approach which is a well-known technique.

[0048] The outgoing end of the above-mentioned line sensor S1 - step S3 is connected to the above-mentioned system controller 15. As for the incorporation by the system controller 15 of the output of a line sensor S1 - step S3, the output is first inputted into the interface circuitry in the focal detector 38. And if it finds the integral by the line sensor control circuit established in an interface circuitry and a correct level is reached, the integrator output will be changed into digital value by the A/D converter, and will be transmitted to a system controller 15.

[0049] Next, with reference to drawing 5 , the main routine which a system controller 15 performs is explained.
[0050] If the power switch which is one of the actuation switches 37 turns on, a power source will be supplied to a system and a system controller 15 will start actuation. A system controller 15 performs initial setting first (step S100). That is, it is initialization of each circuit, starting actuation of the image data controller 25 (DSP), etc. which were connected to memory, the I/O Port, and the system controller 1 (CPU).
[0051] Next, it judges whether in step S101, a system controller 15 has the communication link demand from the external control unit (personal computer) 200 through the communication link interface circuitry 40. If there is a communication link demand here, it will shift to step S102 and a subroutine "a static test mode" will be performed. On the other hand, if there is no communication link demand, it will shift to step S103.
[0052] In addition, in the production process of a camera, required adjustment actuation, the actuation for reading the image data which the user memorized inside the camera, etc. are included in the above-mentioned static test mode.
[0053] In step S103, a system controller 15 inputs the brightness information of a photographic subject from the photometry circuit 22. And a diaphragm-setting value is determined at the time of the shutter second which shows the reset time of image sensors 11 (CCD) based on this brightness information. Furthermore in step S104, a diaphragm-setting value etc. is outputted to the action indication circuit 36 at the time of the data in which the operating state of a camera is shown, and a shutter second.
[0054] Next, a system controller 15 detects the condition of the release switch which is one of the actuation switches 37 in step S105. When this switch turns on here, it shifts to step S108, and if it is OFF, it will shift to step S106.
[0055] In the above-mentioned step S106, a system controller 15 detects the condition of the above-mentioned power switch. If a power switch is OFF here, a system must stop actuation. Therefore, it shifts to step S107 from step S106, and a system controller 15 suspends actuation after performing processing for System Down. On the other hand, if a power switch is ON, in order to continue the actuation as a camera, it shifts to step S103.

[0056] If it shifts to step S108 from the above-mentioned step S105, a system controller 15 will choose one focal area based on the output of the look detector 21 from three focal area (refer to FA1, FA2, FA3, and drawing 4). And in step S109, the integral of the line sensor 66 corresponding to the area chosen to the focal detector 38 is directed.
[0057] It stands by until the integral control action of the selected line sensor 66 ends a system controller 15 in step S110.
[0058] After the integral control action of a line sensor 66 is completed here, the focal detector 38 carries out A/D conversion of the output of each element which constitutes a line sensor 66 into a circuit, and outputs it to a system controller 15. A system controller 15 inputs this changed data at step S111.
[0059] Next, a system controller 15 computes the relative distance (2 image spacing) of two images which the separator lens 65 of a pair formed in up to a line sensor 66 in step S112. In addition, technique well-known as this calculation technique shall be used, and explanation here is omitted.
[0060] Furthermore, a system controller 15 reads criteria 2 image spacing from the above EEPROM 23 in step S113. When the image of the photographic subject by the taking lens 1 carries out image formation of this criteria 2 image spacing on an image sensor, it is the relative distance of two images formed on the above-mentioned line sensor 66. In addition, this 2 image spacing is measured in a subroutine "a static test mode."
[0061] In step S114, a system controller 15 computes the amount of defocusing from the difference of 2 current image spacing for which it asked at the above-mentioned step S112, and criteria 2 image spacing after this.
[0062] Table 1 shows criteria 2 image spacing memorized by EEPROM23.
[Table 1]

フォーカスエリア	基準2像間隔
FA1	67.50(エレメント)
FA2	70.20
FA3	68.90

The specific address on EEPROM23 is set to each of three focal area (FA1, FA2, FA3), and each criteria 2 image spacing is made to memorize with this operation gestalt. The best image formation point changes with the locations which perform focal detection according to the aberration of a taking lens 1. Therefore, it is necessary to memorize criteria 2 image spacing in each of three focal area.
[0063] In addition, although the single focal lens is adopted in the electronic camera of this operation gestalt, when a zoom lens is used, aberration also changes with change of a focal distance. In this case, criteria 2 image spacing according to a focal distance is memorized.
[0064] Next, the principle of the amount detection of defocusing is explained with reference to drawing 11 and drawing 12 . As shown in drawing, when the focus suits on the image sensor, as for 2 image spacing on a line sensor, a certain value is taken. the same [by the error on the dimension of components, variation, and ********] as a design value in fact, although this value can be calculated on a design -- **** -- it does not become. Therefore, if it does not measure in fact, it is difficult to ask for this 2 image spacing (criteria 2 image spacing Lo). 2 image spacing is ********** and a front focus from this criteria 2 image spacing Lo, and if larger than Lo, it is rear focusing so that more clearly than drawing 11 .
[0065] Drawing 12 is drawing having shown the model which excluded the condensing lens from the optical system of AF sensor module 5.
[0066] If movement magnitude of beta and an image is made [the include angle of a chief ray] into deltaL and deltaL' for the scale factor of theta and a separator lens as shown in drawing, the amount L of defocusing can be found by the following formulas.
[0067]
[Equation 1]

$$d = \frac{\Delta L}{\tan\theta} = \frac{\Delta L'}{\beta \cdot \tan\theta}$$

betatantheta is a parameter which becomes settled on the design of AF sensor module 5 here.
[0068] It can ask for deltaL' from criteria 2 image spacing (Lo) and the 2 present image spacing (Lt).
[0069] Returning to drawing 5 , a system controller 15 judges a focus or un-focusing from the calculated amount of defocusing in step S115. When it judges with a focus here, it shifts to step S116.
[0070] At step S116, the conditions determined at step S103 are integrated with an image sensor, and image data is incorporated. After image data is changed into a predetermined format, it is stored in image data-logging media.
[0071] On the other hand, when it judges with un-focusing in step S115, it shifts to step S117. The amount of defocusing is changed into the amount of drives of a lens (pulse number of Px:PI) at this step S117. If it is in a front focus condition here, it will shift to step S119 from step S118, and a motor 41 will be rotated in the direction of CW. Thereby, a taking lens 1 is rounded. The drive of this taking lens 1 is performed until the number of counts of the pulse which a photo interrupter 48 generates is set to Px.
[0072] If the number of counts is set to Px here, a system controller 15 will shift to step S122 from step S121, will apply brakes to a motor 41, and will stop migration of a taking lens 1. And in order to perform focal detection actuation again, it shifts to step S109.
[0073] Moreover, when the direction of defocusing is rear focusing, a system controller 15 shifts to step S120 from step S118, and drives a taking lens 1 in the delivery direction.
[0074] Next, with reference to drawing 6 and drawing 7 , the above-mentioned subroutine "a static test mode" is explained. In addition, the following explanation of operation is fundamentally explained as actuation of a

system controller 15. A system controller 15 inputs the data in which a mode of operation is shown from the external control device 200 in step S200. At step S201, a mode of operation judges whether it is in criteria 2 image-spacing measurement mode. If it is in criteria 2 image-spacing measurement mode here, it will shift to step S203, otherwise, will shift to step S202. In addition, when performing criteria 2 image-spacing measurement mode, the electronic camera 100 concerned is fixed to a bench as beforehand shown in drawing 13 . As for a chart (A), a monochrome stripe is used among drawing. Moreover, the pitch (P) of a stripe and the distance (M) from an electronic camera 100 to a chart set up a suitable value in consideration of the pitch of the pixel which constitutes the resolving power and the image sensor of a taking lens 1 etc.
[0075] Next, a system controller 15 clears a counter of operation in step S203. Furthermore in step S204, the driving signal for rotating a motor 41 in the direction of CW to the lens control circuit 39 is outputted. Thereby, the focusing frame 52 is rounded and starts migration in a direction.
[0076] As long as it continues rotating until part 53a of the focusing frame gear 53 and part 55a of the body of a camera apply and attach the above-mentioned motor 41, and this motor 41 rotates, a photo interrupter 48 continues taking out a pulse signal. Then, if part 53a of the above-mentioned focusing frame gear 53 and part 55a of the body of a camera guess and stick and a motor 41 stops, this pulse signal will disappear.
[0077] It stands by until a system controller 15 detects this pulse signal and this pulse signal disappears in step S205. And if a pulse signal is lost, it will shift to step S206 from step S205, and a brake signal will be outputted to the lens control circuit 39. Thereby, a motor 41 stops. At this time, the focusing frame 52 will have stopped in the location rounded most.
[0078] In order to draw the flux of light of a taking lens 1 to image sensors 11 furthermore, a system controller 15 drives the quick return mirror 3 to UP condition in step S207.
[0079] A system controller 15 drives the above-mentioned diaphragm 2 to a position in step S208. At this time, diaphragm 2 is driven until it becomes the value which is easy to detect the maximum of contrast in image sensors 11. In addition, although an open value is not necessarily the best, generally it is good at the value which carries out diaphragm 2 to disconnection most depending on the property of a lens.
[0080] In step S209, a system controller 15 controls each part to open a focal plane shutter 10. Furthermore at step S210, the integral control action of a line sensor 66 is directed to the image data controller 25 (DSP). At step S2101, it stands by between predetermined time. And after the reset time finishes, it shifts to step S211 and a focal plane shutter 10 is closed.
[0081] A system controller 15 performs charge actuation of a focal plane shutter 10 in preparation for next actuation in step S212. At step S213, it directs to incorporate image data from image sensors 11 to the image data controller 25. At step S214, the positional information of focal area is outputted to the image data controller 25.
[0082] By the image data controller 25, a contrast value is computed from the image data corresponding to three focal area, and it memorizes to DRAM29 through a system controller 15.
[0083] Drawing 8 is the explanatory view having shown the relation of the location of the pixel area which performs image sensors 11 and a contrast operation.
[0084] The operation of contrast is performed for example, based on a degree type.
[0085]
[Equation 2]

$$\text{コントラスト値} = \sum_{n=Sadd}^{Eadd} \left| X_{n+1} - X_n \right|$$

Sadd is the address of memory with which the head pixel data of the area which calculates were memorized here, and Eadd is the address of memory with which the maximum head pixel data of the area which calculates were memorized. Moreover, Xn is the output value of each pixel which constitutes image sensors 11.
[0086] After the contrast operation in the image data controller 25 is completed, a system controller 15 judges whether in step S215, the counted value of a counter of operation became the predetermined count (Nx). When the value of a counter of operation is not Nx here, it shifts to step S216 from step S215.
[0087] A system controller 15 increments a counter of operation at step S216. Moreover, at step S217, the

driving signal for rotating a motor 41 in the direction of CCW to the lens control circuit 39 is outputted. Thereby, the focusing frame 52 starts migration in the delivery direction.
[0088] At step S218, a system controller 15 stands by until the number of the pulse signals generated with a photo interrupter 48 becomes equal to predetermined value Pdelta. And if an impulse counter value is set to Pdelta, it will shift to step S219 from step S218. At step S219, brakes are applied to a motor 41 and migration of a taking lens 1 is stopped. And in order to perform a contrast operation from the output value of image sensors 11 again, it shifts to step S209.
[0089] In addition, in the actuation and the taking lens 1 which calculate a contrast value, specified quantity delivery ****** is repeated until the count reaches Nx. And if the count of actuation reaches Nx, it will shift to step S220 from step S215. At this step S220, a system controller 15 is extracted and returns 2 to an open position.
[0090] Next, a system controller 15 returns the quick return mirror 3 to a Down location in step S221. Furthermore at step S222, the contrast value calculated based on image data is inputted from the image data controller 25.
[0091] Drawing 9 is the explanatory view which plotted the contrast value which asked the axis of abscissa for the count of actuation from the output of image sensors 11 by setting an axis of ordinate as a contrast value.
[0092] A system controller 15 asks for whether the contrast value became max in what time actuation in step S223. And Pdelta is applied to the count of actuation in case a contrast value is max. This count result serves as contrast peak location data (Ppeak).
[0093] As drawing 9 shows, it is the 10th actuation that the contrast value over the 1st focal area FA 1 serves as max. Ten pulses, then the peak location data to the 1st focal area FA 1 serve as 100 (10 time x10) pulses in Pdelta temporarily. That is, if it lets out this lens by 100 pulses from the location to which the taking lens 1 was rounded most, contrast serves as a peak and the image of a chart will carry out image formation on an image sensor.
[0094] It will become 80 pulses if it asks for peak location data from the 2nd focal area FA 2 similarly.
[0095] On the other hand, when the maximum of contrast is the 9th time and 10th in between like the 3rd focal area FA 3, it can compute where [of the 9th time and the 10th between] maximum exists by the technique shown in drawing 10 . That is, straight-line approximation (straight line 1) of the crest left of a contrast curve is carried out using the 8th time and the 9th contrast values C8 and C9. Similarly, straight-line approximation (straight line 2) of the crest right of a contrast curve is carried out using C10 and C11. And if it asks for the intersection of two straight lines, it can know where the maximum of contrast exists.
[0096] And if the 9.4th calculated value becomes, for example, the peak location data of the 3rd focal area FA 3 will serve as 94 pulses. If the peak location data to the three above-mentioned focal area are gathered, it will become as it is shown in Table 2.
[0097]
[Table 2]

フォーカスエリア	コントラスト ピーク位置データ (Ppeak)
FA1	100 (パルト)
FA2	80
FA3	94

Here, it is necessary to determine the count of actuation of contrast detection actuation (Nx), and the amount of deliveries of a lens (Pdelta) in consideration of parameters, such as a conversion ratio at the time of changing the count of the optical property of a taking lens 1, and a motor 41 into migration of a lens 1, and dimension dispersion of the frame supporting a taking lens 1.
[0098] In addition, modification which cannot determine these parameters uniformly and must have been expected is also considered. With this operation gestalt, we decided to memorize Above Nx and Pdelta to EEPROM23 in consideration of this situation. It enabled this to set up the optimal value if needed.
[0099] Next, a system controller 15 stands by at step S2231 until a personal computer 200 switches a chart. The

chart for detecting a contrast peak location is because it is not suitable as a chart for carrying out focal detection by AF sensor of a phase contrast method.
[0100] A system controller 15 sets "1" to a selection counter in step S224 next. The value of this selection counter shows focal area.
[0101] Actuation of next step S225 - step S227 is the same as actuation of the above-mentioned step S204 - step S206. That is, a system controller 15 moves a taking lens 1 to the location rounded most. Contrast peak location data are data measured on the basis of the location to which this taking lens 1 was rounded most. Therefore, in order to move a taking lens 1 to a contrast peak location (focus location), processing of step S225 - step S227 is needed.
[0102] Next, a system controller 15 reads the peak location data of the focal area corresponding to the value of a selection counter from the memory in the system controller 15 concerned in step S2271. for example, the value of a selection counter -- "1" -- if it becomes, the peak location data (Ppeak) of the 1st focal area FA 1 will be read. In addition, Ppeak is set to "100" as shown in Table 2.
[0103] Next, in step S228 - step S230, a system controller 15 lets out a taking lens 1 until the number of impulse counters of a photo interrupter 48 reaches Ppeak. At this time, the photographic subject image formed in the area corresponding to the focal area FA 1 of a line sensor 66 is in a focus condition. It must ask for 2 image spacing formed in the line sensor 66 of AF sensor module 5 at this time.
[0104] Next, in step S231, a system controller 15 issues a command to the focal detector 38 so that it may integrate with the line sensor 66 corresponding to the focal area FA 1. And it stands by until the integral of a line sensor 66 is completed in step S232. And after an integral is completed, after A/D conversion of the output of a line sensor 66 is carried out, it is outputted to a system controller 15.
[0105] The output data of the above-mentioned line sensor 66 are read into a system controller 15 in step S233. At step S234, 2 image spacing corresponding to the focal area FA 1 is calculated from the data of a system controller 15 smell lever. Two image spacing data called for here are criteria 2 image-spacing data to this focal area FA 1. Furthermore, this data is memorized in step S235 to the predetermined address of EEPROM23.
[0106] Next, in step S236, a system controller 15 judges whether the value of a selection counter is "3." If it is not "3" here, it will shift to step S237 and a selection counter will be incremented. And in order to ask for the criteria 2 image-spacing data to the next focal area, it shifts to step S225.
[0107] Thus, if the operation of the criteria 2 image-spacing data to three focal area is completed, the value of a selection counter will be set to "3" and will carry out a return from step S236 to a main routine.
[0108] As explained above, in case focus justification of an image sensor is performed according to the electronic camera concerning the operation gestalt of the above 1st, since it is not necessary to carry out adjustment which removes an image sensor, an adjustment process can be simplified.
[0109] Moreover, not using special equipment like an autocollimator, ** is also can also be adjusted. that is, exact adjustment is realizable, even if it is alike and is in a service center only with easy equipment etc.
[0110] Next, the 2nd operation gestalt of this invention is explained. In the operation gestalt of the above 1st, criteria 2 image spacing was determined on the basis of the location of the taking lens in which a photographic subject image carries out image formation on an image sensor. By the way, in case AF sensor module 5 is designed, criteria 2 image spacing on a design is determined. Therefore, it also becomes possible using criteria 2 image spacing on a design to compute the amount of defocusing. And the movement magnitude (pulse number) of a lens is computed from this amount of defocusing, and if a lens is moved, a photographic subject image will carry out image formation to the focus location on a design.
[0111] However, when the image sensor is not attached as the design value at the body of a camera, there is also a possibility that the focus location on a design and the image pick-up side of an image sensor may not be in agreement. Moreover, when dispersion in the precision generated on manufacture of AF sensor module 5 etc. is taken into consideration, the further device which makes the focus location on a design and the image pick-up side of an image sensor more in agreement with accuracy is needed.
[0112] In consideration of this point, to make the electronic camera of the operation gestalt of **** 2, and it is enabled to be more in agreement with accuracy in the focus location on a design, and the image pick-up side of an image sensor.
[0113] In addition, since the configuration of the electronic camera concerning the operation gestalt of **** 2 is

the same as that of the 1st operation gestalt shown in above-mentioned drawing 1 as long as a block diagram shows, detailed explanation here is omitted and is limited to reference of only a difference.
[0114] In the electronic camera of the operation gestalt of **** 2, drawing 14 is the flow chart which showed the technique of making in agreement a focus location and an image pick-up side, and mainly shows actuation of a system controller 15.
[0115] After initiation of the electronic camera concerned of operation, a system controller 15 judges whether it is a static test mode in step S300, after passing through the same initial setting as the operation gestalt of the above 1st etc. If it is not a static test mode here, it will shift to step S320.
[0116] The condition of Release SW is detected at this step S320. And if this release SW is turned on, it will shift to step S321 from step S320. At this step S321, the same integral control action as the above is performed in AF sensor module 5. This is controlled by the focal detector 38 under control of a system controller 15.
[0117] After the above-mentioned integral is completed, a system controller 15 inputs the sensor data concerned in step S322. And at step S323, 2 image spacing of a photographic subject is computed based on this data.
[0118] next, the system controller 15 -- step S323 -- setting -- the above -- the amount of defocusing is computed from the difference of 2 actual image spacing and 2 image spacing on a design. And this amount of defocusing is changed into the movement magnitude (Px) of a lens in step S325. This is the pulse number of a photo interrupter 48 like the above.
[0119] In step S326, a system controller 15 reads deflection (deltaP) from EEPROM23. This deflection (deltaP) is a parameter measured by the static test mode, and if this deflection does not move to an excess further to Px calculated from the output of AF sensor module 5 for delta P minutes (or delta P minutes few migration), it shows that the image of a photographic subject does not carry out image formation on image sensors 11 (image sensor).
[0120] At step S327, a taking lens 1 drives based on Px and delta P. And in step S328, image data is incorporated by the system controller 15 from image sensors 11 on condition that predetermined.
[0121] On the other hand, if a system controller 15 is judged in the above-mentioned step S300 to be a static test mode, it will shift to step S301. In addition, the electronic camera 100 concerned is attached in the **** bench beforehand shown in drawing 13 at this time.
[0122] The chart concerning the bench concerned is set to Chart B at this step S301. This is for making focal detection easy for AF sensor module 5 to perform. A set of this chart B performs focal detection actuation in step S302 - step S306. In addition, this actuation is the same actuation as step S321 - step S325.
[0123] Next, a system controller 15 drives a taking lens 1 in step S307 based on calculated Px. Furthermore at step S308, the chart concerning the above-mentioned bench is set to Chart A. This is for making easy to perform focal detection actuation by image sensors 11.
[0124] A system controller 15 performs integral control action of image sensors 11 in step S309. Furthermore, image data is incorporated from image sensors 11 at step S310. In step S311, contrast is calculated based on image data after this.
[0125] Next, in step S312, a system controller 15 judges whether contrast became max. If it is not max here, it will shift to step S313 and specified quantity migration of the taking lens 1 will be carried out. And in order to search for contrast again, it shifts to step S309.
[0126] Then, if migration of a taking lens 1 and the operation of contrast are repeated and the peak of contrast is detected, it will shift to step S314 from step S312. At step S314, a system controller 15 asks for the location where contrast became a peak on the basis of the location where the lens was set up in the above-mentioned step S307 as a pulse number of a photo interrupter 48. This serves as deflection (deltaP). This pulse number is memorized to EEPROM23 in step S315.
[0127] Since other operations are the same as that of the operation gestalt of the above 1st, detailed explanation here is omitted.
[0128] According to the electronic camera built over the operation gestalt of the above 2nd as explained above, a focus location and an image pick-up side can be more correctly made in agreement in addition to the same effectiveness as the operation gestalt of the above 1st.
[0129] According to the operation gestalt of **** this invention explained in full detail more than the [additional remark], the configuration like a less or equal can be obtained. Namely, it sets using (1) image

sensor to the electronic image pickup device in which electronic image pick-up actuation is possible. A 1st focal detection means to detect the focal location of an image pick-up lens based on the relative distance of the image with which the flux of light which passed the image pick-up lens is divided, and the divided flux of light forms it, respectively, A 2nd focal detection means to detect the focal location of an image pick-up lens based on the contrast of the image data outputted from an image sensor, The electronic image pickup device characterized by providing a measurement means to measure the control parameter for amending a relative gap of the focal location of the image pick-up lens which controlled the above-mentioned 1st and 2nd focal detection means, respectively, and was detected, respectively.
[0130]
[Effect of the Invention] As explained above, according to this invention, the electronic image pickup device which can perform focus justification of an image sensor more correctly and simple can be offered.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram having shown the configuration of the electronic camera which is the 1st operation gestalt of this invention.
[Drawing 2] It is the important section appearance perspective view having shown the taking lens and lens drive in an electronic camera of an operation gestalt of the above 1st.
[Drawing 3] It is the important section sectional view having shown some of taking lenses in the electronic camera of the operation gestalt of the above 1st, lens drives, and bodies of a camera.
[Drawing 4] It is the important section decomposition perspective view having shown the configuration of AF sensor module in the electronic camera of the operation gestalt of the above 1st.
[Drawing 5] It is the flow chart which showed the main routine which the system controller in the electronic camera of the operation gestalt of the above 1st performs.
[Drawing 6] It is the flow chart which showed the subroutine "a static test mode" in the electronic camera of the operation gestalt of the above 1st.
[Drawing 7] It is the flow chart which showed the subroutine "a static test mode" in the electronic camera of the operation gestalt of the above 1st.
[Drawing 8] It is the explanatory view having shown the area of the pixel which performs the image sensor and contrast operation in an electronic camera of an operation gestalt of the above 1st.
[Drawing 9] It is the diagram having shown an example which plotted the contrast value which asked the axis of abscissa for the count of actuation in the electronic camera of the operation gestalt of the above 1st from the output of an image sensor by setting an axis of ordinate as a contrast value.
[Drawing 10] It is drawing explaining the technique of calculating the approximate value of the maximum of the contrast value in the 3rd ranging area shown in drawing 9 .
[Drawing 11] It is the explanatory view showing the principle of the amount detection of defocusing.
[Drawing 12] It is the explanatory view showing the principle of the amount detection of defocusing.
[Drawing 13] In the electronic camera of the operation gestalt of the above 1st, it is the explanatory view having shown an example at the time of performing criteria 2 image-spacing measurement mode.
[Drawing 14] In the electronic camera of the 2nd operation gestalt of this invention, it is the flow chart which showed the technique of making in agreement a focus location and an image pick-up side.
[Description of Notations]
1 -- Taking lens
2 -- Diaphragm
3 -- Quick return mirror
4 -- Submirror
5 -- AF sensor module
6 -- Pentaprism
7 -- Ocular
8 -- Look detecting element
9 -- Filter
10 -- Lens shutter

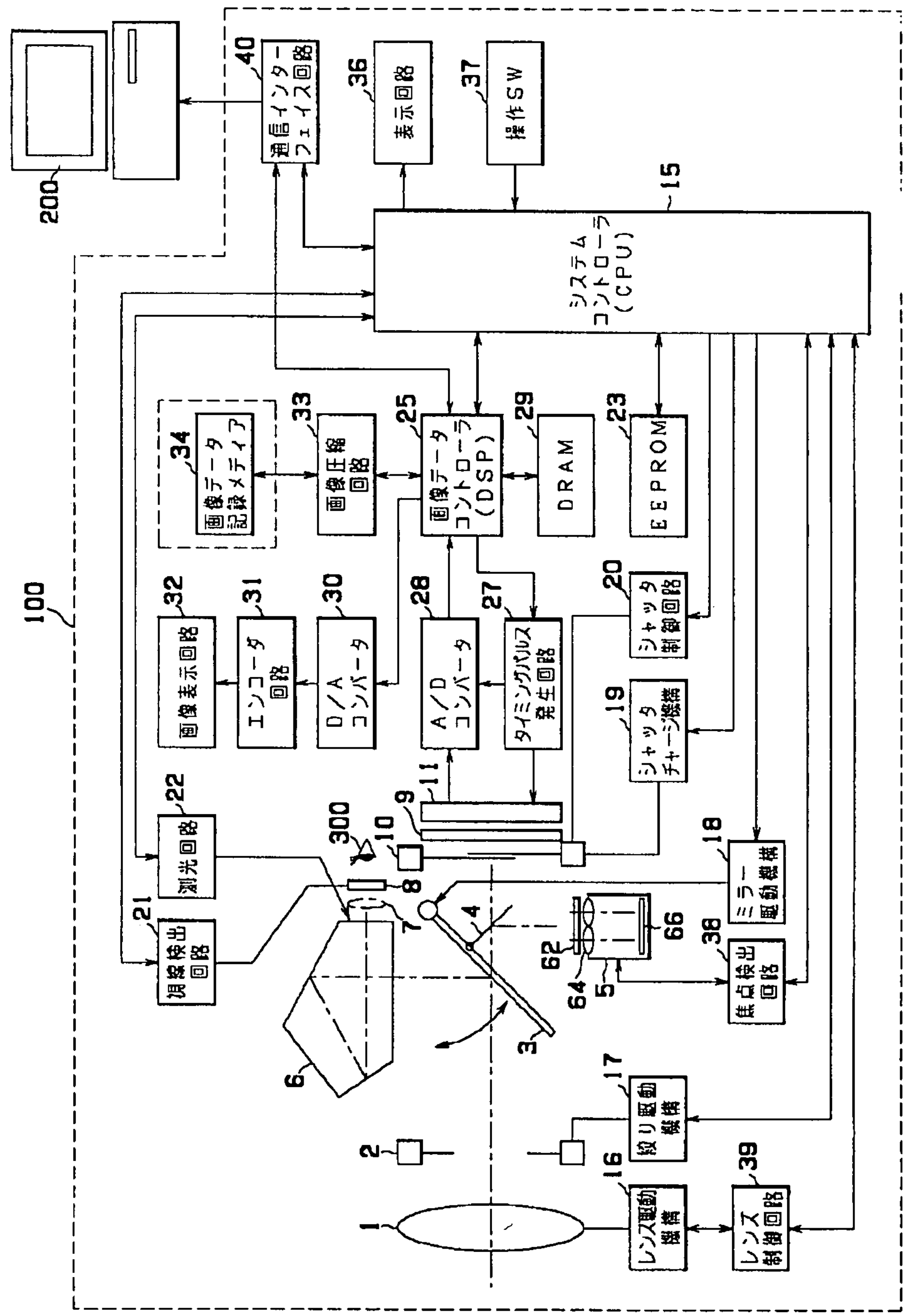
11 -- Image sensors
15 -- System controller
16 -- Lens drive
20 -- Shutter control circuit
21 -- Look detector
22 -- Photometry circuit
23 -- EEPROM
25 -- Image data controller
29 -- DRAM
36 -- Action indication circuit
37 -- Actuation switch
38 -- Focal detector
39 -- Lens control circuit
40 -- Communication link interface circuitry
66 -- Line sensor
100 -- Electronic camera
200 -- Personal computer
300 -- Photography person

[Translation done.]

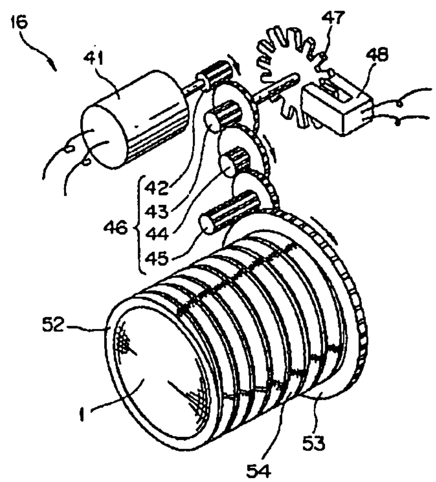
19　　　　20

200…パーソナルコンピュータ　　　　300…撮影者

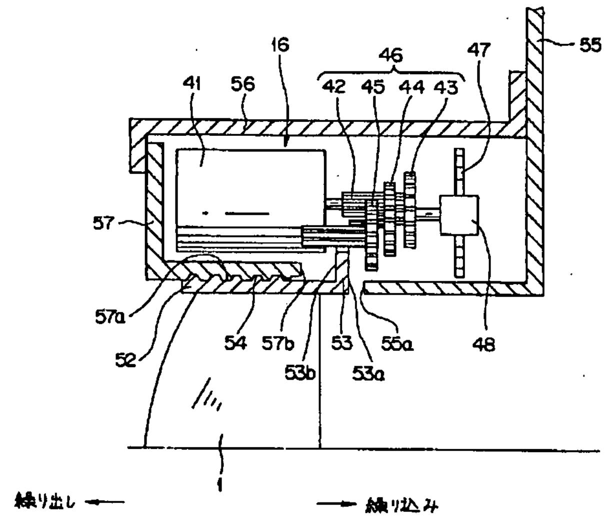
【図1】



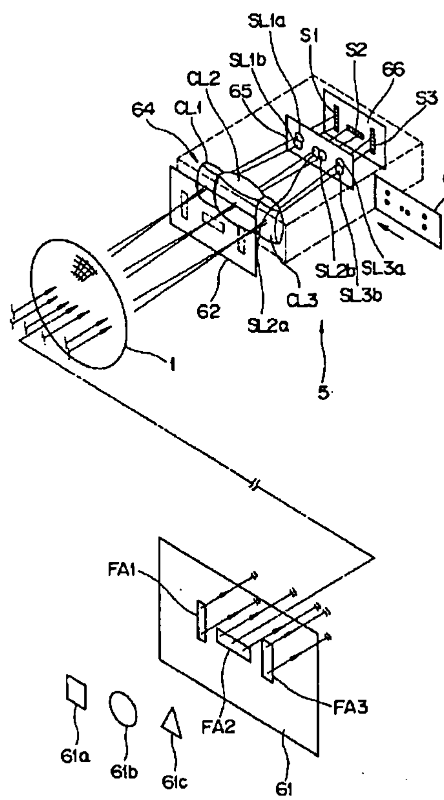
【図2】


16
41
47
48
42
43
44
45
46
52
1
54
53

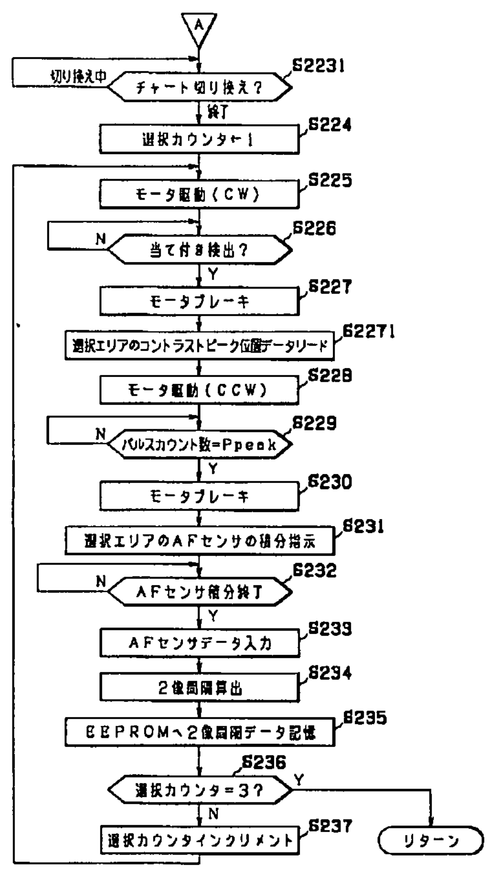
【図3】


16
46
47
55
41
56
42 45 44 43
57
57a
52
54
57b
53
55a
53b
53a
48
1
繰り出し
繰り込み

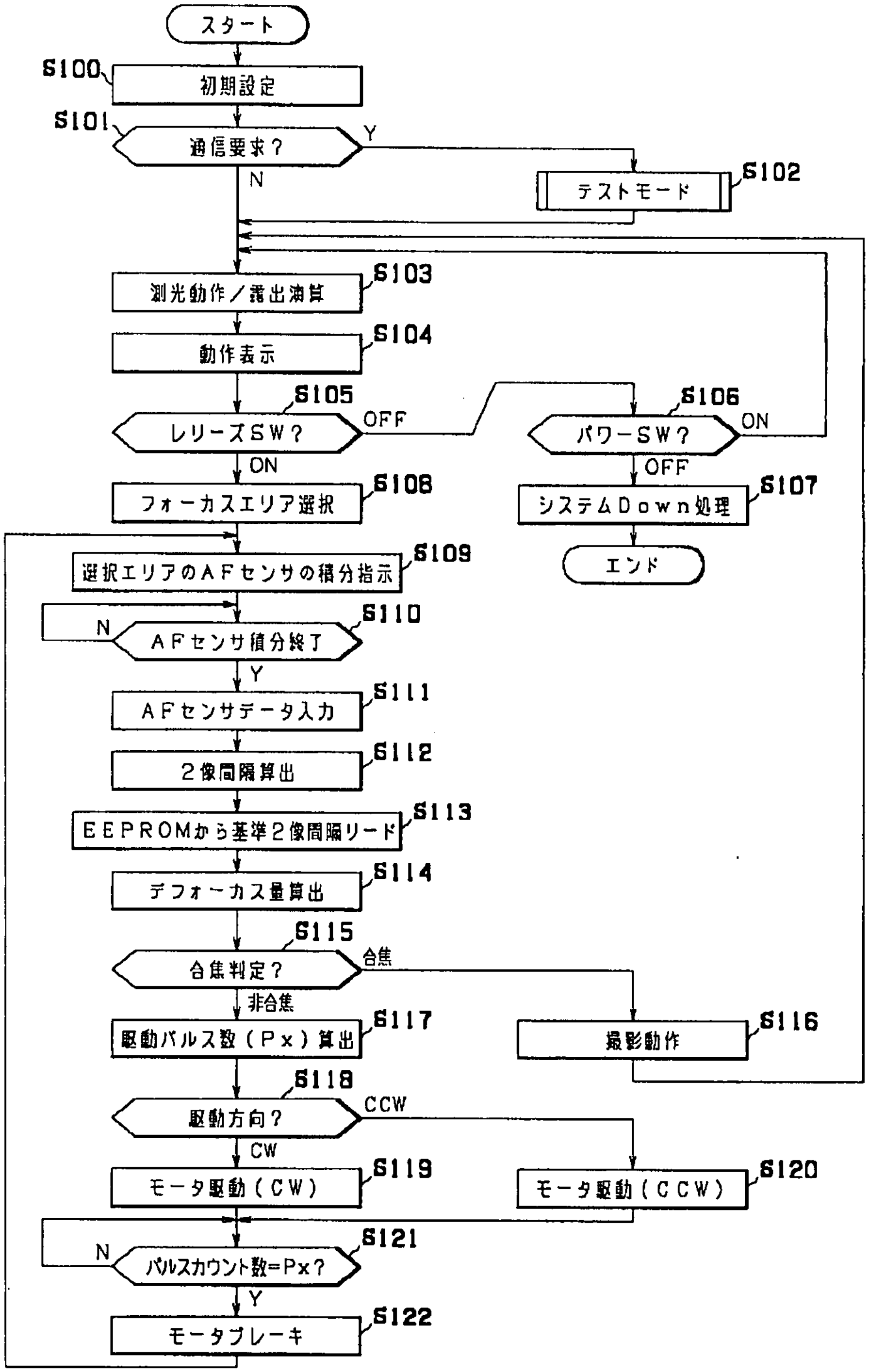
【図4】


SL1a
S1
S2
SL1b
66
CL2
65
S3
64
CL1
63
SL2b
SL3a
SL3b
CL3
62
SL2a
1
5
FA1
FA2
FA3
61a
61b
61c
61

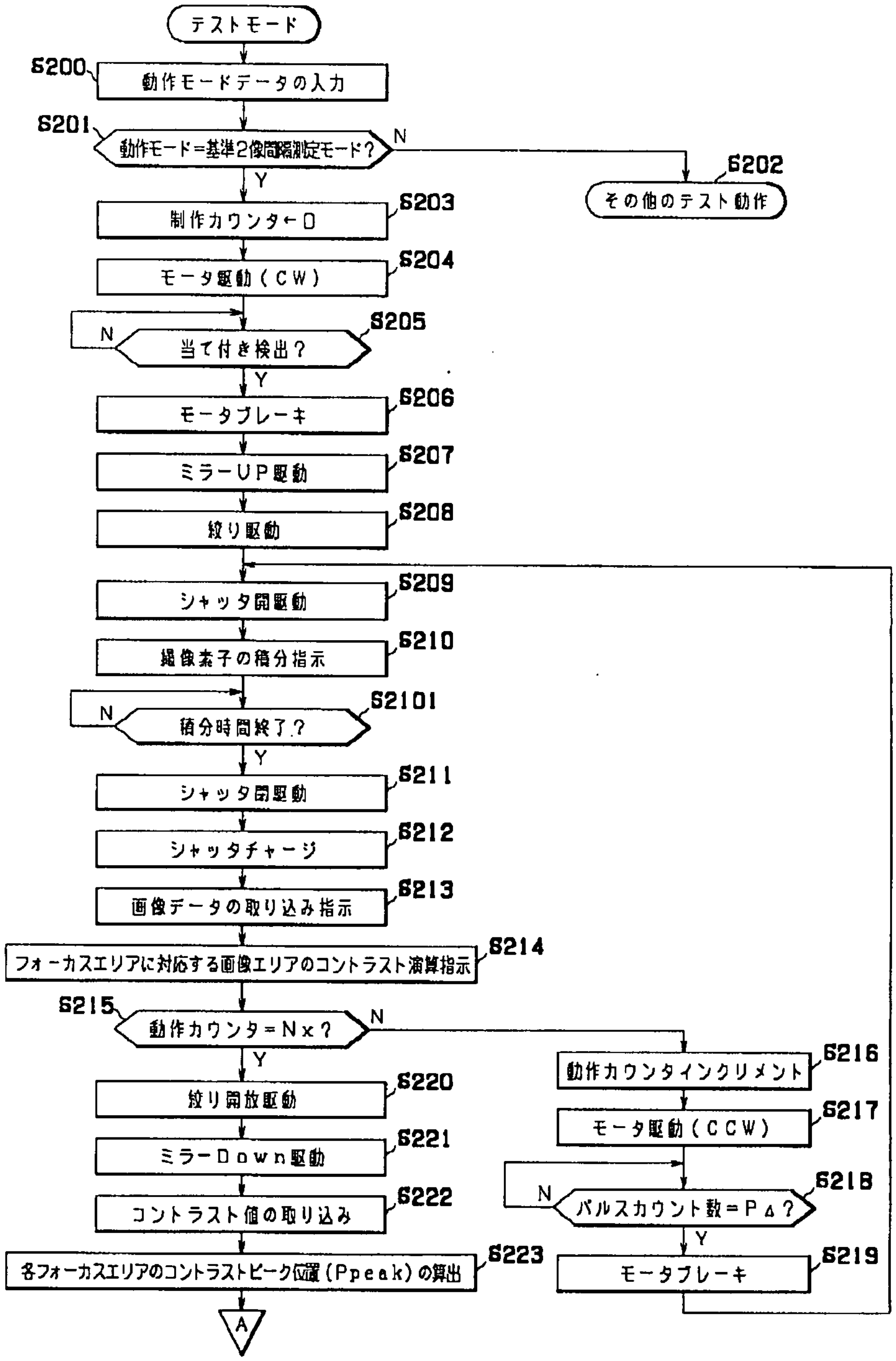
【図7】


A
S2231
切り換え中
チャート切り換え？
終了
S224
選択カウンタ←1
S225
モータ駆動（CW）
S226
N
当て付き検出？
Y
S227
モータブレーキ
S2271
選択エリアのコントラストピーク位置データリード
S228
モータ駆動（CCW）
S229
N
パルスカウント数=Ppeak
Y
S230
モータブレーキ
S231
選択エリアのAFセンサの積分指示
S232
N
AFセンサ積分終了
Y
S233
AFセンサデータ入力
S234
2像間隔算出
S235
EEPROMへ2像間隔データ記憶
S236
選択カウンタ=3？
Y
N
S237
選択カウンタインクリメント
リターン

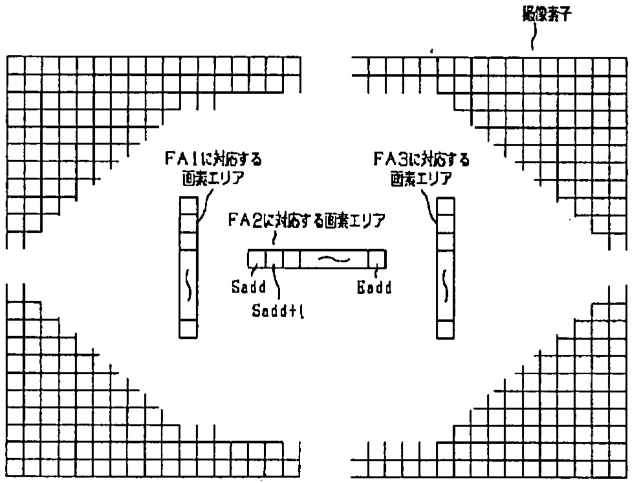
【図5】


スタート
S100 初期設定
S101 通信要求？
Y
N
S102 テストモード
S103 測光動作／露出演算
S104 動作表示
S105 レリーズSW？
OFF
ON
S106 パワーSW？
ON
OFF
S107 システムDown処理
エンド
S108 フォーカスエリア選択
S109 選択エリアのAFセンサの積分指示
S110 AFセンサ積分終了
N
Y
S111 AFセンサデータ入力
S112 2像間隔算出
S113 EEPROMから基準2像間隔リード
S114 デフォーカス量算出
S115 合焦判定？
合焦
非合焦
S116 撮影動作
S117 駆動パルス数（Px）算出
S118 駆動方向？
CCW
CW
S119 モータ駆動（CW）
S120 モータ駆動（CCW）
S121 パルスカウント数=Px？
N
Y
S122 モータブレーキ

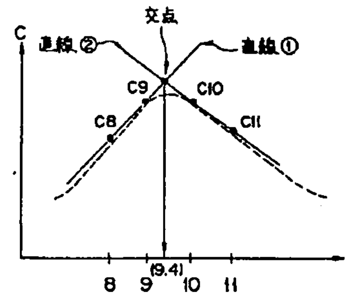
【図6】


テストモード
S200
動作モードデータの入力
S201
動作モード＝基準2像間隔測定モード?
N
Y
S202
その他のテスト動作
S203
制作カウンタ←0
S204
モータ駆動（CW）
S205
当て付き検出？
S206
モータブレーキ
S207
ミラーUP駆動
S208
絞り駆動
S209
シャッタ開駆動
S210
撮像素子の積分指示
S2101
積分時間終了？
S211
シャッタ閉駆動
S212
シャッタチャージ
S213
画像データの取り込み指示
S214
フォーカスエリアに対応する画像エリアのコントラスト演算指示
S215
動作カウンタ＝Nx？
S216
動作カウンタインクリメント
S217
モータ駆動（CCW）
S218
パルスカウント数＝PΔ？
S219
モータブレーキ
S220
絞り開放駆動
S221
ミラーDown駆動
S222
コントラスト値の取り込み
S223
各フォーカスエリアのコントラストピーク位置（Ppeak）の算出
A

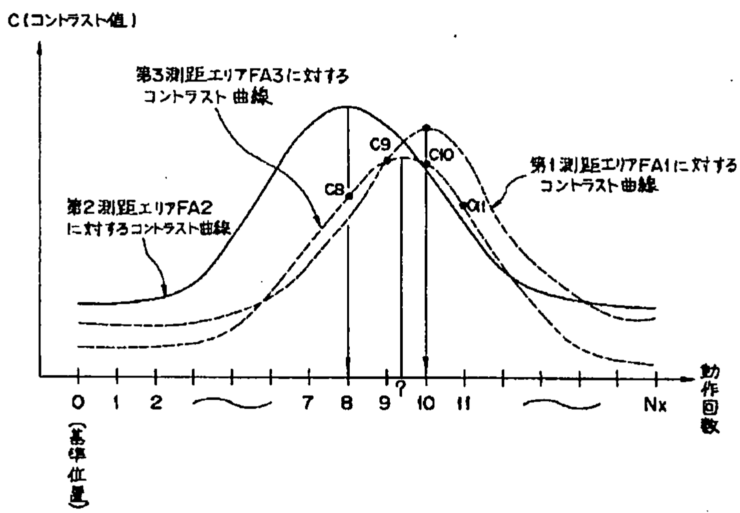
【図８】


撮像素子
FA1に対応する
画素エリア
FA3に対応する
画素エリア
FA2に対応する画素エリア
Sadd
Sadd+1
Eadd

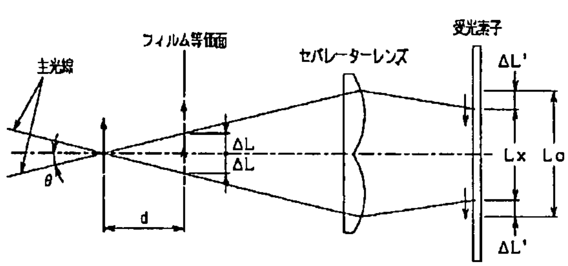
【図１０】


C
交点
直線②
直線①
C9
C10
C8
C11
(9.4)
8
9
10
11

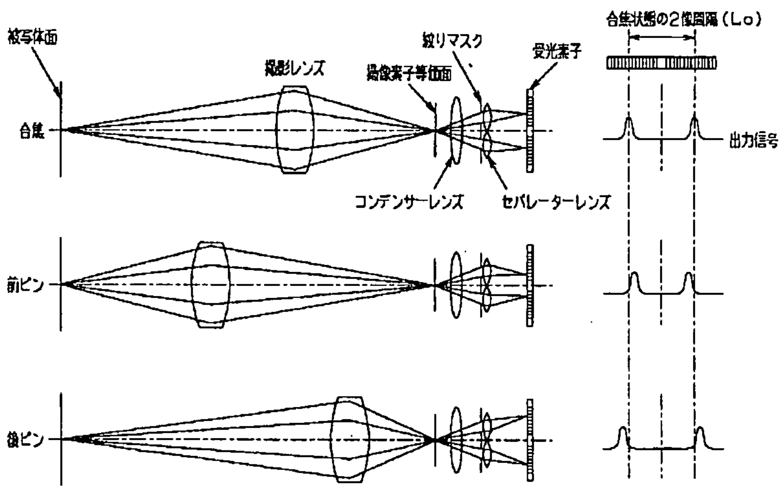
【図９】


C(コントラスト値)
第3測距エリアFA3に対する
コントラスト曲線
第2測距エリアFA2
に対するコントラスト曲線
第1測距エリアFA1に対する
コントラスト曲線
C8
C9
C10
C11
0
1
2
7
8
9
?
10
11
Nx
(基準位置)
動作回数

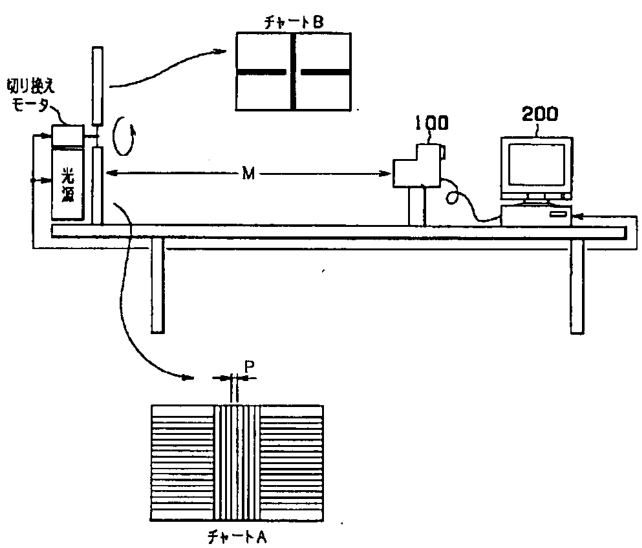
【図１２】


主光線
フィルム等価面
セパレーターレンズ
受光素子
ΔL
ΔL
ΔL'
ΔL'
Lx
Lo
θ
d

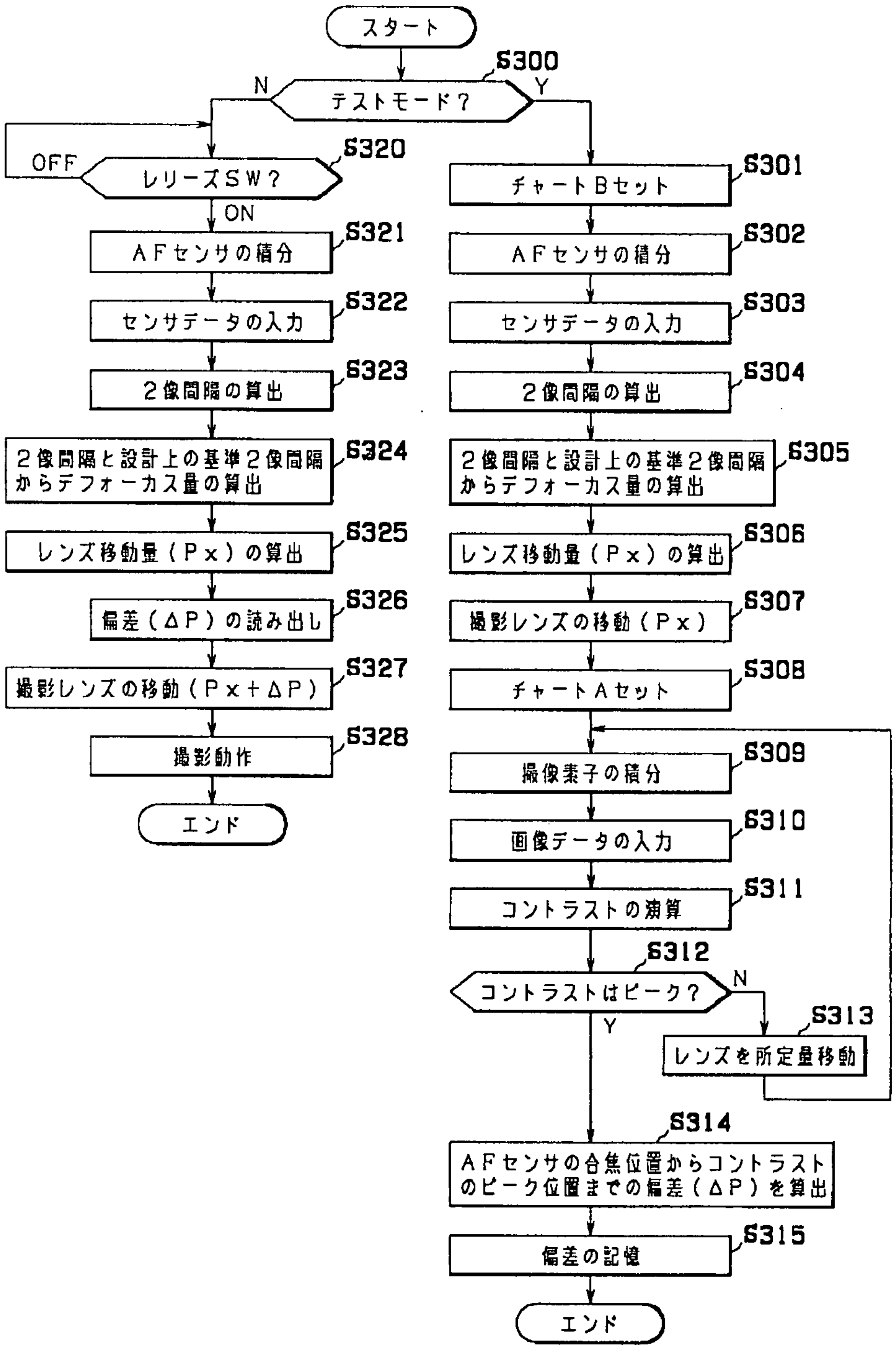
【図11】


被写体面
撮影レンズ
撮像素子等価面
絞りマスク
受光素子
合焦状態の2像間隔(Lo)
合焦
出力信号
コンデンサーレンズ
セパレーターレンズ
前ピン
後ピン

【図13】


チャートB
切り換えモータ
光源
M
100
200
P
チャートA

【図14】


スタート
S300
テストモード？
N
Y
S320
OFF
レリーズSW？
ON
S321
AFセンサの積分
S322
センサデータの入力
S323
2像間隔の算出
S324
2像間隔と設計上の基準2像間隔からデフォーカス量の算出
S325
レンズ移動量（Px）の算出
S326
偏差（ΔP）の読み出し
S327
撮影レンズの移動（Px＋ΔP）
S328
撮影動作
エンド
S301
チャートBセット
S302
AFセンサの積分
S303
センサデータの入力
S304
2像間隔の算出
S305
2像間隔と設計上の基準2像間隔からデフォーカス量の算出
S306
レンズ移動量（Px）の算出
S307
撮影レンズの移動（Px）
S308
チャートAセット
S309
撮像素子の積分
S310
画像データの入力
S311
コントラストの演算
S312
コントラストはピーク？
N
Y
S313
レンズを所定量移動
S314
AFセンサの合焦位置からコントラストのピーク位置までの偏差（ΔP）を算出
S315
偏差の記憶
エンド